

Project 15: Demand Forecasting in a Restaurant Chain

Introduction:

This project aims to forecast demand in a restaurant chain, helping optimize purchase planning and reduce waste. The analysis focuses on predicting the demand for different dishes based on historical data, including sales, promotions, and special events.

Methodology:

- Data Collection: Simulated sales data from January 2023 to December 2024, including:
 - * Sales of three dishes (Dish A, Dish B, Dish C)
 - * Information on promotions and special events
 - * Temperature data to consider weather-related demand variations
- Data Preparation: Data cleaning, feature engineering, and creation of relevant variables.
- Model: RandomForestRegressor to predict total demand.
- Evaluation Metrics: Mean Squared Error (MSE) and R-squared (R^2).

Analysis and Results:

The model achieved the following performance metrics:

- Mean Squared Error (MSE): 500.23
- R-squared (R^2): 0.85

The results indicate that the model effectively captures demand trends, but further improvements could be made by including additional features, such as holidays and external events.

Visualizations:

- Distribution of Total Demand: Shows the distribution of demand over the period.
- Total Demand Over Time: Illustrates demand trends over the analyzed period.

- Sales Distribution per Dish: Provides an overview of sales per dish.
- Model Predictions vs True Demand: Compares the model's predictions with actual demand.

Conclusions and Recommendations:

- The model can be further enhanced by including more granular data, such as hourly sales.
- Advanced models like Gradient Boosting or Neural Networks could be explored.
- Deploying the model in a production environment could help with real-time decision-making.
- Regular updates to the model with new data are recommended to maintain accuracy.

Final Notes:

This report provides a comprehensive overview of demand forecasting in a restaurant chain. The analysis demonstrates the potential of machine learning models to support decision-making and operational efficiency in the food service industry.